



The Dengue Update



A CDC Update on a Critical Disease Threat

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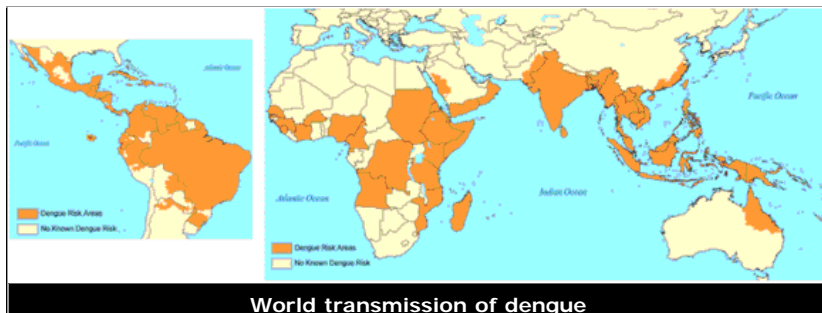
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Dengue – A Worldwide Threat

Dengue, one of the most serious diseases affecting children in the tropics, is caused by a mosquito-borne virus related to those causing yellow fever and West Nile. More than 40% of the world's population lives in dengue endemic areas and as many as 100 million people a year become infected. Each year there are an estimated 500,000 cases, mostly children, of the potentially deadly dengue hemorrhagic fever.



This bulletin is the first of what will be periodic reports on dengue. Our purpose is to provide you with concise, informative updates on global efforts to prevent dengue, and particularly the role of the Centers for Disease Control and Prevention (CDC) in those efforts. In this inaugural issue, we focus on the threat of dengue to the United States.

First, a little background. Dengue is caused by four closely related viruses, commonly referred to as serotypes (dengue-1, -2, -3, and -4). Infection with one serotype elicits life-long immunity, but only to that serotype and there is evidence that subsequent infection with another serotype increases the chance of developing dengue hemorrhagic fever or dengue shock syndrome. Typically, an epidemic of one serotype is followed a few years later by an epidemic with one of the others. In Southeast Asia, for example, most teenagers have already been exposed to multiple types.

The transmission of the dengue virus between humans is primarily the work of the "yellow fever mosquito," *Aedes aegypti*. A small, dark mosquito with white markings, *Aedes aegypti* thrives in all but the coldest climates worldwide, including much of the southern United States. Typically, 8 - 12 days after the female mosquito feeds on an infected human, it can pass the virus to another human. *Aedes aegypti*, which commonly bites during daylight, is uniquely adapted to living in and around human habitations, where it lays eggs in artificial containers, like pet water bowls, vases, and discarded plastic trash. There is not yet a dengue vaccine and controlling the mosquito "vector" is the only method for preventing transmission. Although highly useful, effective mosquito control is difficult to sustain. In future issues, we will discuss work underway for developing both vaccines and innovative methods for mosquito control.

Dengue – A Threat to the United States



Although commonly thought of as a disease of the tropics, dengue is no stranger to the United States. The first detailed description of the disease was written by Dr. Benjamin Rush, signer of the Declaration of Independence, who studied cases during a 1780 epidemic in Philadelphia. Dengue disappeared from the continental U.S. by the early 20th century and it remained relatively rare everywhere until after World War II. Since 1952, however, when the first cases of dengue hemorrhagic fever were described in the Philippines, dengue has grown to pandemic proportions and again constitutes a threat to the U.S.

As the world has become more accessible, the risk from exotic pathogens has increased. For example, non-immigrant visitors and temporary residents to the United States increased from 12 million in 1987 to 37 million in 2007. As many as 17 million Americans traveled to endemic countries in 2007. Dengue is now more common than malaria among travelers returning to the United States from the Caribbean, South America, South Asia and Southeast Asia. The vectors

of dengue are found as far north as New Jersey and Chicago, a range that could increase as the climate warms. Equally important to the direct threat is the enormous economic burden dengue puts on America's allies and trade partners.

1. **U.S. outbreaks.** Not only do Americans travel to endemic countries but citizens from endemic

countries come to the U.S. Because the mosquito vector is common in parts of the U.S., an infected traveler can touch off localized dengue outbreaks. Most recently, this happened in Key West, Florida during summer, 2009. In 2005, it was estimated that as many as 1250 dengue infections occurred in the Lower Rio Grande Valley of Texas, including the first locally-transmitted case of classic dengue hemorrhagic fever. In a 2001 epidemic on Maui, Hawaii as many as 40% of the residents of some towns became infected.

2. **U. S. Territories.** Puerto Rico has experienced dengue since the 18th century. The entire population of the island, four million people, is at risk. In non-epidemic years 2,000 – 3,000 cases may be detected, but during epidemic years, as in 2007, it can be more than 10,000. The American Virgin Islands, Guam, Northern Marianas, and American Samoa are at risk for sporadic dengue outbreaks.
3. **Transfusion-associated dengue risk.** Not everyone infected with dengue will have symptoms and, consequently, the virus can be transmitted via blood transfusion or organ transplants. In Puerto Rico, about 1 in 600 blood donations was found to contain virus during the 2007 epidemic, 1 in 1300 during a non-outbreak year. Sensitive, inexpensive tests are not yet available for screening donated blood either in endemic areas or in parts of the mainland most likely to have donors returning from endemic places.
4. **Travel-associated dengue among U.S. residents.** Americans frequently travel for business or pleasure to dengue endemic places in Asia and Latin America, and every year hundreds return infected with dengue. We know that travel-related dengue cases are underreported. Beginning in 2010, dengue will be a nationally reportable disease in the United States.

CDC's Dengue Branch

Dengue is a dangerous disease and a complex one. CDC's Dengue Branch, located in San Juan, Puerto Rico, has 65 staff, including physicians, epidemiologists, immunologists, molecular biologists, entomologists, and mathematicians. It is the largest research facility in the world solely dedicated to the prevention and control of dengue and it has broad responsibilities.

Its core activity, conducted in collaboration with the Puerto Rico Department of Health, is to continually monitor dengue incidence throughout the island. This activity, which began in 1975 provides a unique insight to the mechanics of transmission, such as seasonality and succession of serotypes, that adds value to all other activities at the Branch. The Dengue Branch is at the forefront of developing more accurate and more rapid methods for diagnosing dengue infections in the laboratory. It trains local health care workers in the clinical diagnosis and management of dengue in an effort to prevent potentially fatal medical complications from occurring. The well regarded public education unit promotes preventive measures, such as yard cleanup, in the local media and working with local civic groups. The Branch participates in the development of candidate dengue vaccines and also develops field test sites.

It tests innovative tools and strategies to kill the mosquito vectors, and it develops models to uncover risk factors, such as climate change, and to predict where and when epidemics will occur.

More widely, the Dengue Branch is a World Health Organization Collaborating Reference Center for Dengue and its Spanish-speaking staff has long been a resource for the Pan American Health Organization and the Caribbean Epidemiology Center for training and diagnosis. The Branch was instrumental in working with the Council of State and Territorial Epidemiologists in 2009 to make dengue a nationally notifiable disease in the United States.

